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Measurements of the kinetic-energy-release (KER) of vibrational cooled HeH^+ and H_3^+ at the electrostatic Frankfurt low energy storage ring (FLSR)

J. C. Müller^{*1}, R. Dörner^{*}, F. King^{*}, L. Ph. H. Schmidt^{*}, M. S. Schöffler^{*}, K. E. Stiebing^{*2}

^{*}Institute for Nuclear Physics, Goethe Universitaet, Max von Laue Str. 1, D-60438 Frankfurt am Main, Germany

Synopsis The KER for electron capture of vibrational cooled HeH^+ and H_3^+ ions at 20 keV from residual gas atoms has been measured in the Frankfurt Low Energy Storage Ring (FLSR). At a vacuum in the order of few 10^{-11} mbar, this residual gas consists to 99% of H_2 molecules. For the identification of the recoil products of this reaction, a recoil spectrometer (with an MCP-detector with position and time sensitive read out) was installed at one of the focus points (IP) in the FLSR. The planned extension of this set up by a gas target to a full COLTRIMS reaction microscope will be discussed.

The Frankfurt Low Energy Storage Ring (FLSR) [1] is a fully electrostatic device designed for the storage of ions with a total energy of up to 50 keV. As no magnetic fields are involved, the ion mass of the stored ions is not limited by the ion optics of the ring. FLSR has racetrack geometry with a circumference of 14.7 m resulting in a revolution time of e.g. 4.5 μs for 50 keV protons. The four-fold super symmetry of the ring provides four straight sections with regions of enhanced ion density (interaction points (IP)) for carrying out experiments and/or beam diagnostics. For the detection of neutralized atoms/molecules two position and time sensitive MCP-detector systems are installed at the 0° - and 180° - port of the ring (see Figure 1).

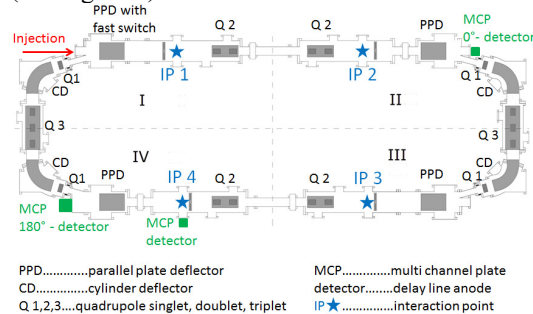


Figure 1: Schematic view of FLSR.

In Figure 2 results are presented from an experiment on the dissociative recombination of vibrational cooled HeH^+ ions on an electron target [2]. For this experiment an electron gun was installed at IP 4. As this reaction channel does not offer the possibility to identify the reaction by measuring a recoil ion we have substituted

the electron gun by a recoil ion spectrometer in order to identify the competing capture channel of the reaction. The results of this new experiment will be reported.

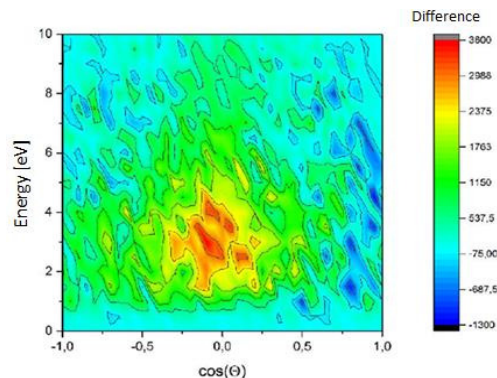


Figure 2: 3D plot of the KER to the momentum in electron beam direction ($\cos(\Theta) = p_x/p_{\text{ges}}$) [2]

In order to complete this set up also for user defined target gas species, it is planned to install a gas target at IP-4 of FLSR, providing a full COLTRIMS reaction microscope for future experiments at the ring. The design of this set up will be presented.

References

- [1] K. E. Stiebing *et al* 2010 *Nucl. Instr. and Meth.* **A614**,10
- [2] F.King 2015 "Experimente zum dissoziativen Elektroneneinfang in raumfeste Molekulationen im Frankfurter Speicherring" PHD-thesis IKF

¹ E-mail: janmueller@atom.uni-frankfurt.de

² E-mail: stiebing@em.uni-frankfurt.de

